

Amendments to the Specification:

Please replace the second paragraph on page 2 with the following amended paragraph:

In general, the performance of an electronic device depends not only upon the structure grown or formed on the substrate surface, but also upon the properties of the substrate itself. For example, the doping level in the substrate may affect series resistance and current density distribution if the current flows through the substrate, junction capacitance for junction isolated devices, or latch-up tolerance in devices with parasitic thyristors (such as CMOS ICs). Defect densities are also important, affecting leakage currents and device reliability. In the case of an optical device emitting through the substrate (such as a NECSEL (Novalux® Extended Cavity Side Surface Emitting Laser)), optical absorption in the substrate is also important.

Please replace the third paragraph on page 3 with the following amended paragraph:

In the particular case of a NECSEL or bottom emitting VCSEL (Vertical Cavity ~~Side-Surface~~ Surface Emitting Laser), the importance of the substrate properties is as follows. The current flowing to the gain region passes through the substrate. High conductivity is required to keep the series resistance low and prevent too much current crowding at the device perimeter. This can be achieved through the use of a heavily doped, thick substrate. On the other hand, optical loss must be kept low and this means a low doping level and thin substrate. A third requirement arises from the need to maintain device operation within specification over its entire lifetime. A key element in achieving this is to keep the defect density in the substrate low. An acceptable trade-off between these three requirements (low resistance, low optical loss and low defect density) is difficult to achieve in commercially available substrate materials.

Please replace the paragraph bridging pages 4 and 5 with the following amended paragraph:

The active components, electrical contacts etc. are formed on top of the grown semiconductor layer using well-established wafer-scale fabrication techniques. At an appropriate stage during this fabrication, the original substrate material is removed from the whole wafer by any suitable technique (mechanical polishing, chemical etching, chemical-mechanical polishing (CMP), chemical or physical plasma etching etc.) leaving only a sufficient

thickness of the grown semiconductor layer to provide mechanical support for the active components once they are separated into individual die. Typically, the thinning of the wafer will be performed at or close to the end of the active device fabrication sequence so that the thicker starting material is present to provide mechanical support during most or all of the wafer fabrication sequence.

Please replace the paragraph bridging pages 6 and 7 with the following amended paragraph:

Referring to Fig. 2, an example of a semiconductor fabrication process for an optical device is presented according to an embodiment of the present invention. In this embodiment, wafer 111 is selected to meet the defect density requirements of the optical device without regard to doping density. Suitable GaAs wafers with low defect densities (etch-pit density, or EPD, values of less than 500cm^{-2}) are readily available from manufacturers but typically have doping levels of approximately $1 \times 10^{18} \text{ cm}^{-3}$ or higher. Such material is commonly grown using a well-known VGF (vertical gradient freeze) technique. The high doping level typically renders them unsuitable for NECSELs. A GaAs layer, 112, is then grown on the starting substrate. The thickness of this layer is selected to provide sufficient mechanical support for the final devices while the doping level (uniform ~~or~~ non-uniform) is selected for optimum laser performance. With proper selection of growth conditions, the defect density in the grown layer will be similar to or better than that of the starting substrate. Once the high-quality support layer, 112, is grown, the rest of the device fabrication may proceed as shown in Fig. 1. The device layer 113 is grown, and the NECSEL device is fabricated with electrical contacts 115. A key element of the present invention, however, is that the wafer thinning step now removes all of the starting substrate 111. In this way, when the device is completed, with anti-reflective coating (ARC), 116, and an optical aperture, 117, none of the original substrate remains. It is thus possible to combine arbitrary doping profiles (including very low dopant density) with the low defect density normally requiring high dopant density.